REMARKS

The Examiner's attention to the present application is noted with appreciation.

35 U.S.C. § 112

In Section 3 of the Office Action of September 5, 2008, the Examiner rejected claims 1-6, 9-11, 13-19, 27, 39, 42, 44, and 47-52 under 35 U.S.C. § 112 ¶ 1 as failing to comply with the enablement requirement.

The Examiner asserted that claim 1 must be broader than claim 2 and must include substrates which are not a metal, metal alloy or metal-containing compound. Applicant has cancelled claim 2 and has amended claim 1 to recite:

> A deposition method comprising the steps of: providing a substrate comprising an active substrate comprising at least one material selected from the group consisting of a metal, metal alloy, and metal containing compound; contacting the substrate with a non-aqueous organic solution comprising a desired deposition galvanic coating component, the desired deposition galvanic coating component having a more noble composition than the less noble composition of the active substrate; and spontaneously displacing the active substrate with the desired deposition galvanic coating component.

Thus, Applicant believes claim 1 is now allowable. Claims 3-5, 9-11, 13-19, 27, 44, and 48-51 depend on amended claim 1, and thus are also believed to be allowable. Claims 2, 6, 39, 42, 47, and 52 have been cancelled.

The Examiner asserted that claim 1 must be broader than claim 4 and must include deposition components which are not a metal, metal alloy or metal-containing compound. Applicant has amended claim 4 and added new claims 56 through 59. Thus, Applicant believes claims 1 and 4, as well as 56 through 59, are now allowable.

The Examiner asserted that Applicant has provided no guidance as to how it is determined whether deposition components are more or less noble than an active substrate, and that such a determination would involve undue experimentation. Applicant respectfully directs the Examiner's attention to the fact that a deposition component to be deposited on a substrate will not deposit on the substrate unless it is more noble than the substrate. See Electroless Plating: Fundamentals and Applications, by Glenn O. Mallory, Juan B. Hajdu, American Electroplaters and Surface Finishers Society, Contributor Glenn O. Mallory, published by William Andrew Inc., 1990, page 512, where displacement plating is defined as "the deposition of a more noble metal on a substrate of a less noble, more electronegative metal." Applicant also directs the Examiner's attention to the specification, page 22, lines 9 and 10, which teaches nickel films sputtered onto silicon wafers used as a substrate and to page 11 lines 7-10 which teaches an active nickel substrate **20** over a copper substrate **22**. The nickel is originally a substrate **20**, as taught on page 11 line 7. The nickel substrate **20** subsequently performs as a seed

layer, as taught on page 11, line 11 when the gold replaces the nickel in a galvanic coating process, or cementation reaction, as described on page 14, lines 22-26, and the nickel dissolves into the organic solution. Amended independent Claim 1 recites, in part: "spontaneously displacing the active substrate with the desired deposition galvanic coating component" and teaches the relationship between the active nickel substrate and the gold-loaded organic solution: Thus, Applicant teaches a substrate comprising an active nickel substrate, in contact with an organic solution loaded with gold which is complexed with an organic compound, reduced at cathodic sites on the active substrate to the metallic state (e.g. gold atoms). Page 10, lines 25-26. Additionally, nickel is less noble than gold as seen at http://www.eng-tips.com/faqs.cfm?fid=78. See in the specification: "Given the general physical laws known for metals, a "more" Noble metal dissolved in an organic solution will preferentially deposit on a "seed" layer of a "less" Noble metal plated on a substrate. For example, Au, Pt, Pd, Cu, and Ag would all readily plate on substrates such as Al, Cd, Ti, Ta, Zn, Fe, and Si, or mixtures thereof." Page 9, lines 16-20 of the specification. Thus, Applicant now believes that claim 1 is allowable.

In Section 4 of the Office Action, the Examiner asserted that claim 1 must be but is not broader than claims 39 and 47. Applicant has cancelled claim 39 and claim 47.

In Section 5 of the Office Action, the Examiner asserted that claims 50 and 52 are rejected under 35 U.S.C. § 112 ¶ 1 as failing to comply with the written description requirement. In section 6, the Examiner asserted that basis for the step of removing a barrier layer is not apparent. Applicant respectfully directs the Examiner's attention to page 16, lines 4-7 where removing a barrier layer is expressly stated: "A particularly useful pre-treatment method utilizes an HBF_4 solution to both potentially clean and/or remove the barrier surface layer (*e.g.*, oxidized layer). It is preferred that HBF_4 (or other halogenated pre-treatment solutions), such as but not limited to fluorosiliac, HF, sodium fluoride or any other halogen solutions." Thus, Applicant believes claim 50 is allowable.

In section 7, the Examiner asserted that basis for the step of "sensitizing" the active substrate is not apparent. Claim 52 has been cancelled.

In Section 9 of the Office Action, the Examiner rejected claims 1-6, 9-11, 13-19, 27, 39, 42, 44, and 47-52 under 35 U.S.C. § 112 ¶ 2 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant has amended claim 1 to clarify that the deposition component of line 7 is the same desired deposition component recited in lines 5-6. Thus, Applicant now believes that claim 1 is allowable. Claims 3-5, 9-11, 13-19, 27, 44, and 48-51 depend on amended claim 1 and are also believed to be allowable.

In Section 12 of the Office Action, the Examiner asserted that the use of the words "or displacing" in claim 3 created an inconsistency between claims 1 and 3. Applicant has amended claim 3 to remove the words "deposited or displacing."

In Section 13 of the Office Action, the Examiner asserted that the use of the word "further" in claim 3 indicated that the seed composition is in addition to something else, contradicting Applicant's

statements that the deposition component itself forms seeds. Applicant has amended claim 3 to remove the word "further." Thus, Applicant now believes that claim 3 is allowable.

In Section 14 of the Office Action, the Examiner stated that it was not apparent if the claim was limited to 0.25%. Applicant has amended claim 49 to recite: "The method of claim 1 wherein the organic solution comprises less than 0.25% water by volume." Thus, Applicant now believes that claim 49 is allowable.

In Section 15 of the Office Action, the Examiner asserts that it remains unclear how it is determined whether materials included in the scope of claim 1 are more or less noble. Applicant has amended claim 1 to recite in part: "A deposition method comprising the steps of: providing a substrate comprising an active substrate comprising at least one material selected from the group consisting of a metal, metal alloy, and metal containing compound.;" Claim 1 is now limited to metals and alloys. Thus, Applicant believes claim 1 is now allowable.

Claim Objections - 37 CFR 1.75(c)

In Section 16 of the Office Action, the Examiner objected to claims 39, 42, and 47 under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant has cancelled claims 39, 42, and 47.

Claim Rejections- 35 U.S.C. § 102

In Section 20 of the Office Action, the Examiner rejected claims 1-6, 8, 9, 11, 13, 15-18, 25, 39, 42, 44, 46, 47, and 49 under 35 U.S.C. § 102(a) as being anticipated by the article "Pd-Cu Co-deposition on TiSiN as seeds for electroless plating," by Jingye Li. Applicant respectfully directs the Examiner's attention to the nature of the Li "article." It is a work summary prepared as an internal quarterly report to the inventors of the present invention. This work was never published. Accordingly, this reference is not applicable under 35 U.S.C. § 102(a). Applicant apologizes for not explaining fully the nature of this unpublished report on the Information Disclosure Statement.

In Section 23 of the Office Action, the Examiner rejected claims 1-6, 9-11, 14, 18, 19, 27, 39, 42, 44, 47, 48, and 50-52 under 35 U.S.C. § 102(b) as being anticipated by the article "An Alternative Metallic Seeding Technique for Subsequent Electrochemical Deposition of Copper onto Barrier Metals," by Fang et al.

Fang et al. discloses that the use of an organic solution differs from that of an aqueous solution, as demonstrated in the table on page 140 where the open circuit potential for Ag, Cu, Zn and Al in three different organic solutions, D2EHPA, TBP, and Aliquat 336, are listed. The standard open circuit potentials for those metals in aqueous solutions, Ag = +0.80V, Cu = +0.34V, Zn = -0.76V, and Al = -1.66V, are significantly different than all of the values listed in the table. In addition, whether one metal is more or less noble than another is dependent on the organic solution, as in D2EHPA Ag (0.16V) is more noble

than Cu (-0.16V) while in TBP Cu (-0.16V) is more noble than Ag (-0.29V). Thus, an organic solution is different from an aqueous solution. Nevertheless, Applicant has amended claim 1 to more accurately describe the present invention's limitations. Amended claim 1 recites, in part: "spontaneously displacing the active substrate with the desired deposition galvanic coating component." Nowhere does Fang teach a galvanic coating method. Applicant therefore believes that independent claim 1 and all dependent claims are now allowable.

Additionally, Applicant directs the Examiner's attention to page 6, lines 1-2, lines 12-13, and lines 17-18 where Applicant discloses that neither of these articles discusses the particular deposition coating process of the present invention, which uses galvanic coating and a displacement reaction.

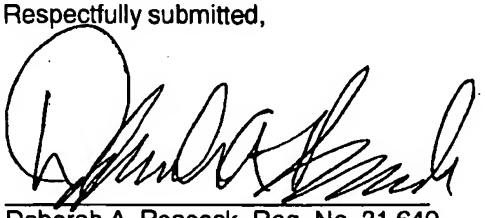
Claim Rejections - 35 U.S.C. § 103(a)

In Section 28 of the Office Action, the Examiner rejected claim 13 under 35 U.S.C. § 103(a) as being unpatentable over Fang et al. "An Alternative Metallic Seeding Technique for Subsequent Electrochemical Deposition of Copper Onto Barrier Metals." The Examiner asserts that deposition of more than one metal as disclosed by Fang et al. would have been obvious. Applicant has amended claim 1 to more accurately describe the present invention's limitations. Amended claim 1 recites, in part: "spontaneously displacing the active substrate with the desired deposition galvanic coating component." Nowhere does Fang teach or render obvious a galvanic coating method. Applicant therefore believes that independent claim 1 and dependent claim 13 are now allowable.

In Section 30 of the Office Action, the Examiner rejected claim 44 under 35 U.S.C. § 103(a) as being anticipated by the article "Pd-Cu Co-deposition on TiSiN as seeds for electroless plating," by Jingye Li. The Examiner asserts that it would have been obvious to use ambient temperatures or temperatures above ambient. Again, Applicant respectfully directs the Examiner's attention to the nature of the Li "article." It is a work summary prepared as an internal quarterly report to the inventors of the present invention. This work was never published. Thus, Applicant believes claim 44 is allowable.

If any issues remain, or if the Examiner believes that prosecution of this application might be expedited by discussion of the issues, the Examiner is cordially invited to telephone the undersigned attorney for Applicant at the telephone number listed below. Please charge any additional fees or credit overpayment to Deposit Account No. 13-4213.

Respectfully submitted,



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Deborah A. Peacock, Reg. No. 31,649
Direct line: (505) 998-1501

PEACOCK MYERS, P.C.
Attorneys for Applicant(s)
P.O. Box 26927
Albuquerque, New Mexico 87125-6927
Telephone: (505) 998-1500
Facsimile: (505) 243-2542

Customer No. 005179

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galvanic coupling (contact plating) of the substrate with a catalytic metal. After the reaction is initiated, the metal deposited serves as the catalyst, thus ensuring continuous buildup of the metal. Continuous build-up of the metal is what distinguishes autocatalytic (electroless) plating from the contact and displacement methods.

Autocatalytic, or the commonly used term "electroless", plating is almost as old as electroplating (1). The first description by von Liebig in 1835 was with the reduction of silver salts by reducing aldehydes. Despite its early start, progress in the field remained slow until World War II.

Other chapters will describe autocatalytic (electroless) methods in more detail, including mechanisms, chemistry, components, and applications.

DISPLACEMENT (IMMERSION) PLATING

Displacement plating, sometimes called immersion plating, is the deposition of a more noble metal on a substrate of a less noble, more electronegative metal by chemical replacement from an aqueous solution of a metallic salt of the coating metal. This process differs from the autocatalytic method in both mechanisms and its results (9,1). Displacement plating requires no reducing agents in solution.

The method used is based on the ability of one metal to displace another from a solution as a deposit. The substrate dissolves and is stoichiometrically replaced by the deposit. The electrons are furnished by the dissolution of the metallic substrate. Immersion deposition ceases as soon as the substrate is completely covered by the metal coating, whereas autocatalytic (electroless) plating knows no limit to the thickness of deposit that is obtainable (10). To reiterate, displacement coatings consist of more noble metal ions in solution

Corrosion engineering FAQ

GALVANIC SERIES CHART

faq338-78

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GALVANIC SERIES OF COMMONLY USED METALS WHEN EXPOSED TO SEA WATER

ACTIVE OR LEAST NOBLE

Magnesium
Magnesium Alloys
Zinc
Galvanized Steel

Aluminum 1100

Aluminum 6053
Alcad

Cadmium

Aluminum 2024 (4.5 Cu, 1.5 Mg 0.6 Mn)

Mild Steel
Wrought Iron
Cast Iron

13% Chromium Stainless Steel
Type 410 (Active)
18-8 Stainless Steel
Type 304 (Active)
18-12-3 Stainless Steel
Type 316 (Active)

Lead-Tin Solders
Lead
Tin

Maganese Bronze
Naval Brass

Nickel (Active)
76 Ni - 16 Cr - 7 Fe Alloy (Active)

60 Ni - 30 Mo - 6 Fe - 1 Mn

Yellow Brass
Admiralty Brass
Aluminum Brass
Red Brass
Copper
Silicon Bronze

70:30 Cupro Nickel
G-Bronze
M-Bronze
Silver Solder
Nickel (Passive)
76 Ni - 16 Cr - 7 Fe Alloy (Passive)

67 Ni - 33 Cu Alloy (Monel)

13% Chromium Stainless Steel
Type 410 (Passive)
Titanium

18-8 Stainless Steel
Type 304 (Passive)
18-12-3 Stainless Steel
Type 316 (Passive)

Silver

Graphite
PASSIVE OR Gold
MORE NOBLE Platinum

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